

# **Five-Year Review Report**

## **First Five-Year Review Report**

**for**

**Maxey Flats Disposal Site**

**Fleming County, Kentucky**

**September 2002**

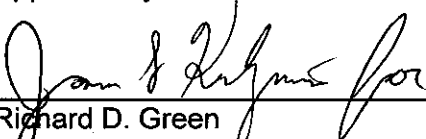
**PREPARED BY:**

**United States Environmental Protection Agency**

**Region 4**

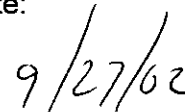
**Atlanta, Georgia**

Approved by:

  
\_\_\_\_\_  
Richard D. Green

Waste Division Director  
U.S. EPA Region 4

Date:

  
\_\_\_\_\_  
9/27/02

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Richard D. Green  
Waste Division Director  
U.S. EPA Region 4

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## ***List of Acronyms***

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ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DAW	Dry Active Waste
EDB	east detention basin
EMDC	east main drainage channel
EPA	U.S. Environmental Protection Agency
IMP	Interim Maintenance Period
IRP	Initial Remedial Phase
LR/D	leachate removal and disposal
Maxey Flats	Maxey Flats Disposal Site
NCP	National Contingency Plan
OSWER	Office of Solid Waste and Emergency Response
PCP	Process Control Program
PSVP	Performance Standards and Verification Plan
ROD	Record of Decision
RW	remaining work
SARA	Superfund Amendments and Reauthorization Act
SOW	Statement of Work

## Five-Year Review Summary Form

SITE IDENTIFICATION			
<b>Site name (from WasteLan):</b> Maxey Flats Disposal Site			
<b>EPA ID (from WasteLan):</b>			
<b>Region:</b> 4	<b>State:</b> Kentucky	<b>City/County:</b> Fleming	
SITE STATUS			
<b>NPL status:</b> <span style="background-color: #cccccc;">Final</span> Deleted Other (specify): _____			
<b>Remediation status</b> (choose all that apply): <span style="background-color: #cccccc;">Under construction</span> Operating Complete			
<b>Multiple OUs?*</b> YES <span style="background-color: #cccccc;">NO</span>		<b>Construction completion date:</b> Pending	
<b>Has site been put into reuse?</b> YES <span style="background-color: #cccccc;">NO</span>			
REVIEW STATUS			
<b>Lead agency:</b> <span style="background-color: #cccccc;">EPA</span> State Tribe Other Federal Agency _____			
<b>Author name:</b> Derek Matory			
<b>Author title:</b> Sr. Remedial Project Manager		<b>Author affiliation:</b> U.S. EPA, Region 4	
<b>Review period**:</b> 06/2001 to 09/2002			
<b>Date(s) of site inspection:</b> Ongoing, 6/5-6/2002			
<b>Type of review:</b> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <span>only</span> <span><span style="background-color: #cccccc;">Post-SARA</span></span> <span>Pre-SARA</span> <span>NPL-Removal</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <span>State/Tribe-lead</span> <span>Non-NPL Remedial Action Site</span> <span>NPL</span> </div> <div style="display: flex; justify-content: center; margin-top: 10px;"> <span>Regional Discretion</span> </div>			
<b>Review number:</b> <span style="background-color: #cccccc;">1 (first)</span> 2 (second) 3 (third) Other (specify) _____			
<b>Triggering action:</b> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <span><span style="background-color: #cccccc;">Actual RA Onsite Construction at OU #NA</span></span> <span>Actual RA Start at OU #_____</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <span>Construction Completion</span> <span>Previous Five-Year Review Report</span> </div> <div style="margin-top: 10px;">             Other (specify) _____              _____           </div>			
<b>Triggering action date (from WasteLAN):</b> 06/1997			
<b>Due date (five years after triggering action date):</b> 06/2002			

\* ["OU" refers to operable unit.]

\*\* [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

## **1.0 Introduction**

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The Maxey Flats Disposal Site (Maxey Flats), located in Fleming County, Kentucky, is an inactive low-level radioactive waste site owned by the Commonwealth of Kentucky in Fleming County, Kentucky, approximately 10 miles northwest of Morehead, Kentucky.

The Initial Remedial Phase (IRP) Remedial Action (RA) at Maxey Flats is on-going pursuant to the Consent Decree (Civil Action Number 95-58) signed by the Maxey Flats Steering Committee (Settling Private Parties), the Commonwealth of Kentucky, and the U.S. Environmental Protection Agency (EPA). The IRP RA at Maxey Flats utilizes source control technology to solidify and contain wastes on Maxey Flats and prevent off-site migration of low-level radiological contaminants. The RA is divided into two phases: leachate removal and disposal (LR/D) activities and remaining work (RW) construction.

Pursuant to the Consent Decree Section X - EPA Periodic Reviews, the Maxey Flats Steering Committee shall provide information, as required, such that the EPA may perform statutory five-year reviews. The statutory five-year reviews shall be conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Section 300.430 (f) (4) (ii). CERCLA and the NCP require that statutory five-year reviews shall be conducted at sites which upon completion of the RA will leave hazardous substances, pollutants, or contaminants on site above clean-up levels that allow unlimited use and unrestricted exposure.

The trigger for the statutory five-year review is the initial mobilization to perform RA construction work. The IRP RA construction mobilization at Maxey Flats commenced in June 1997; there the initial statutory five-year review is due in June 2002. The purpose of the initial statutory five-year review is to assess whether the selected remedy is being constructed in accordance with the ROD and IRP RD/RA documents and to determine if the remedy will be protective of human health and the environment when completed. In subsequent 5-year reviews, verification that the IRP RA is functioning as designed and that applicable operations and maintenance activities are being performed will also be evaluated. This will be accomplished by review of current Maxey Flats environmental data collected by the Commonwealth of Kentucky as part of its ongoing operations and maintenance obligations, and by assessment of current Maxey Flats conditions relative to the Record of Decision (ROD) specified RA objectives.

**TABLE 1-1  
GENERAL CHRONOLOGY OF EVENTS**

<b>Month/Year</b>	<b>Activity</b>
<b>September 1991</b>	U.S. EPA (EPA) issues the Record of Decision for the Maxey Flats Disposal Site, Fleming County, Kentucky
<b>1992</b>	EPA issues Special Notice to the Potentially Responsible Parties.
<b>1992-1995</b>	Settling Defendants Consent Decree and Statement of Work, <i>de minimis</i> Consent Decree, Settlement Agreement between the Federal Agencies and the Settling Private Parties, Steering Committee Participation and Cost Sharing Agreement, and the Operating Agreement of the Maxey Flats Site IRP, L.L.C. negotiated between Settling Private Parties, Commonwealth of Kentucky, Settling Federal Agencies and EPA.
<b>July 1995</b>	-Maxey Flats Disposal Site Consent Decree, U.S. District Court No. 95-58, is lodged. -Settling Private Parties (SPPs) initiate installation of Pre-IRP Construction cover.
<b>October 1995</b>	SPPs complete installation of Pre-IRP construction cover.
<b>April 1996</b>	Consent Decree is entered by the Court.
<b>June 1996</b>	EPA holds site visit for SPPs, Commonwealth, EPA, and Maxey Flats Concerned Citizens Group to discuss SPP's IRP Remedial Design Kick-off.
<b>July 1996</b>	-EPA approves the SPP's JUN96 Technical Memorandum of the Pre-Remedial Design Background Review. -EPA approves SPPs JUN96 Limited Initial Data Acquisition (LIDA); SPPs implement.
<b>October 1996</b>	EPA approves the SPP's JUL96 Remedial Design Work Plan (RDWP) and supporting documents.



**TABLE 1-1  
GENERAL CHRONOLOGY OF EVENTS**

<b>Month/Year</b>	<b>Activity</b>
<b>November 1996</b>	EPA approves the SPPs JUL96 Health and Safety Plan (HASP).
<b>February 1997</b>	EPA provides concurrence and comments on SPPs DEC96 Preliminary Leachate Removal/Disposal (LR/D) Design Report.
<b>May 1997</b>	EPA conditionally approves SPP's APR97 Prefinal LR/D Design Report.
<b>June 1997</b>	-Commonwealth of Kentucky (Commonwealth) issues and withdrawals dispute on well abandonment for UG-2. -SPPs mobilize to site, initiate limited LR/D Construction (mobilization, site preparation, bunker construction, and Leachate Storage Facility construction).
<b>November 1997</b>	EPA conditionally approves Commonwealth's JUN96 Initial Remedial Phase (IRP) Monitoring and Maintenance Plan. IRP Monitoring and Maintenance Plan Revision 1 issued January 1998.
<b>December 1997</b>	SPPs submit Preliminary Remaining Work (RW) Design to EPA (Data acquisition and design criteria for borrow soils, well and sump abandonment, lateral extent of the IRP cap, and storm water management).
<b>January 1998</b>	EPA approves SPP's 9DEC97 Final LR/D Design Report.
<b>August 1998</b>	EPA holds Public Open House at Maxey Flats Disposal Site to discuss IRP Remedial Action Start-up.
<b>September 1998</b>	SPPs complete LR/D Construction; Leachate removal and disposal operations begin.
<b>October 1998</b>	EPA provides concurrence and comments on SPP's DEC97 RW Prefinal Design and RAWP.
<b>February 1999</b>	-SPPs initiate Early Start RW activities (site preparation and building demolition). -EPA holds Public Meeting, Fleming County Courthouse, to discuss LR/D Operations winter shutdown.

**TABLE 1-1  
GENERAL CHRONOLOGY OF EVENTS**

<b>Month/Year</b>	<b>Activity</b>
<b>March 1999</b>	SPPs have spill, less than reportable quantities pursuant to 40CFR 302.4, Appendix B.
<b>April 1999</b>	-EPA approves SPPs 98OCT HASP Revision 1. -SPPs issue 31MAR99 Spill Incident Report to EPA.
<b>June 1999</b>	SPPs initiate construction of Phase IIA EMC Bunkers and Early Start RW Southeast Cap construction. (Phase IIA Bunkers demolished in 2002 due to the capacity no longer being required.)
<b>October 1999</b>	EPA holds Public Open House at Maxey Flats Disposal Site to review ongoing IRP LR/D activities.
<b>February 2000</b>	SPP's issue 31MAR99 Spill Incident Closure Report to EPA.
<b>August 2000</b>	EPA approves attainment of Leachate Removal Performance Standards; Leachate removal operations cease and shutdown/decommissioning is initiated.
<b>September 2000</b>	EPA holds Public Open House at Maxey Flats Disposal Site to discuss LR/D decommissioning and RW construction
<b>October 2000</b>	SPPs initiate balance of RW construction (IRP cap and storm water drainage system).
<b>2001 - present</b>	SPPs continue RW Construction.

## ***2.0 Summary of Initial Remedial Phase Remedial Actions and Objectives***

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### ***2.1 Summary of Initial Remedial Phase Remedial Actions***

The major remedy components of the LR/D and RW phases for the IRP RA included Source Control, Surface Water and Erosion Control, along with Access Control, Security and Notification. The Source Control component involved removal and solidification and on-site disposal of trench leachate, along with the initial cap (IRP Cap) installation to minimize storm water infiltration into the existing trench disposal area. The Surface Water and Erosion Control component includes lined drainage channels routing storm water run-off to the east detention basin (EDB), EDB modifications controlling storm water run-off into the east main drainage channel (EMDC), stabilization improvements to the EMDC, and installation of erosion control measures to minimize hillslope and IRP Cap erosion. The Access Control, Security and Notification component includes measures to prevent inadvertent intrusion to Maxey Flats, establishment of a buffer zone, installation of permanent surface erosion monuments, along with notification of the nature and approximate quantity of disposed waste at Maxey Flats.

### ***2.2 Remedial Action Objectives***

The RA objectives are found in Section II of the Statement of Work (SOW). These objectives and the measures taken to implement them are detailed in Table 2-1.

**Table 2-1**  
**Status of SOW Remedial Action Objectives**  
**(1 of 4)**

Number	SOW Remedial Action Objective	Implemented Measure
1	Prevent or mitigate the continued release of hazardous substances, pollutants and contaminants from the MFDS to underlying bedrock formations and GW aquifers.	<ul style="list-style-type: none"> <li>- Extracted leachate from MFDS trenches (sumps) in accordance with the approved LR/D design methodology for conveyance to field collection tanks and solidification in EMC bunkers. Of the 56 trenches and 274 sumps at MFDS, 49 trenches and 201 sumps were pumpable.</li> <li>- The criteria stated in Reference 29 ("Guidelines for Trench Dewatering at Maxey Flats Disposal Site", September 1993 by R.G. Cockrell) for leachate extraction were impractical and neither feasible nor measurable; and were not used to show the completion of leachate extraction. Data supporting the conclusion that the remedial action objective had been met was comprised of four elements:               <ul style="list-style-type: none"> <li>(1) Leachate removal had diminished to asymptotic levels.</li> <li>(2) Leachate levels across the site had been reduced to the extent practicable.</li> <li>(3) Hazardous constituent removal had diminished to small quantities.</li> <li>(4) The level of effort required to continue operations increased dramatically relative to the amount of leachate removed with no corresponding increase in performance standard attainment.</li> </ul> </li> <li>- EPA gave approval for leachate stop pumping on August 25, 2000.</li> </ul>
2	Prevent or mitigate the continued release of hazardous substances, pollutants and contaminants from the Site to surface water bodies and	<ul style="list-style-type: none"> <li>- This objective was fulfilled by implementing measures described for Remedial Action Objectives 1, 6, and 8.</li> </ul>
3	Reduce the risks to human health associated with direct contact with hazardous substances, pollutants or contaminants within Site.	<ul style="list-style-type: none"> <li>- This objective was fulfilled by implementing measures described for Remedial Action Objectives 7, 9, and 10.</li> </ul>
4	Eliminate or minimize the threat posed to human health and the environment from current and potential migration of hazardous substances from the Site in the surface water, ground water, and subsurface and surface soil and rock.	<ul style="list-style-type: none"> <li>- This objective was fulfilled by implementing measures described for Remedial Action Objectives 1, 5, 7, and 8.</li> </ul>
5	Minimize the infiltration of rainwater into the trench areas and migration from the trenches.	<ul style="list-style-type: none"> <li>- GW Modeling was performed and identified areas with potential for infiltration of rainwater into the existing trenches. The subsurface extension of the IRP Cap in the southeast corner was installed to minimize the potential for rainwater infiltration into the existing trenches.</li> <li>- The cap was enlarged from ~46 acres to ~58 acres.</li> <li>- The North Channel to the north of the 40 series disposal trenches, intercepts the LMB. Pursuant to TC 122, the North Channel was redesigned to avoid intercepting the LMB in the west because of high tritium concentrations in investigative soil samples.</li> <li>- The perimeter areas outside the cap limits drain away from Cap and the trenches.</li> </ul>

**Table 2-1**  
**Status of SOW Remedial Action Objectives**  
**(2 of 4)**

Number	SOW Remedial Action Objective	Implemented Measure
6	Allow natural stabilization of the Site to provide a foundation for a final cap over the trench disposal area that will require minimal care and maintenance over the long term.	<ul style="list-style-type: none"> <li>- The IRP Cap was installed to facilitate repair of subsidence until the final cap is constructed. The areal extent for the IRP Cap was determined utilizing geophysical site delineation, GW Modeling, previous site data, and Reference 28.</li> <li>- Earthwork construction and geomembrane liner installation for the IRP Cap are in accordance with the RW Construction Specifications which complied with applicable construction standards and manufacturer's specifications. The cap was designed to minimize care and maintenance during the IMP. <ul style="list-style-type: none"> <li>- In-situ soils were collected to demonstrate the on-site material met property requirements.</li> <li>- Geotechnical testing was performed to classify the material and determine compaction (maximum density and optimum moisture).</li> <li>- Geomembrane liner was installed per specification requirements.</li> <li>- Commonwealth will monitor for subsidence during the IMP pursuant to initial stabilization criteria established in the IMP PSVP.</li> </ul> </li> </ul>
7	Minimize the mobility of trench contaminants by extracting trench leachate to the extent practicable and by solidifying the leachate in EMC bunkers.	<ul style="list-style-type: none"> <li>- Reinforced-concrete bunkers were constructed in accordance with approved design documents.</li> <li>- The EMC bunkers meet the requirements of Reference 27 ["Selection of a Method for Disposing of Grout Made with Trench Leachate at Maxey Flats Disposal Site", June 1992 by R.G. Cockrell] providing long-term stability and isolation of the solidified radioactive waste. They provide protection against inadvertent intrusion due to reinforced concrete and were enhanced with a concrete top slab, additional waterproofing (Vandex), and application of coating materials (InstaCote).</li> <li>- Prior to placement of the IRP Cap over the EMC bunker area, Phase I roof slab will have an additional coating material applied to minimize surface water infiltration.</li> <li>- Extracted leachate was classified and solidified in accordance with 902 KAR 100:021, Section 6 and 10 CFR Parts 61.55-.56.</li> <li>- During solidification operations a Process Control Program (PCP) was used to confirm the adequacy of each batch of leachate and dry cement prior to full-scale solidification. To quantify strength, a strength puncture test at 55 psi was performed on each PCP batch of grout.</li> <li>- The approved testing methodologies and water to cement ratios were in accordance with the previously approved Topical Report; referenced as a NRC document number for Solidified Waste Forms and HICs, Office of Nuclear Materials and Safeguards, number SEG WM-46. Upon completion and EPA approval of the DAR, work instructions were generated to control the collection, transfer, and solidification of the grout.</li> <li>- The water to cement ratio for the solidified leachate was in accordance with the previously approved Topical Report meeting the requirement of less than 0.5% free standing liquids and minimization of voids.</li> <li>- The method of Dry Active Waste (DAW) placement minimized potential void spaces within each lift in the</li> </ul>

**Table 2-1**  
**Status of SOW Remedial Action Objectives**  
**(3 of 4)**

Number	SOW Remedial Action Objective	Implemented Measure
8	Control the Site drainage and minimize the potential for erosion to protect against natural degradation.	<ul style="list-style-type: none"> <li>- The IRP Cap (RW construction) is designed so that the overall drainage and perimeter drainage channels provide finished grades to assure cap drainage and eliminate high channeled velocities/ flows which could potentially damage the Cap.</li> <li>- The drainage contouring and design flows meet Reference 28 criteria.</li> <li>- The IRP Cap design eliminated the west detention basin and south weir and routed storm water flows to the EDB through the perimeter channels.</li> <li>- The existing trench area is covered with IRP Cap (earth fill placement and geomembrane liner) preventing erosion in the disposal trench area.</li> <li>- Riprap, Gabion baskets, and AB mats were placed along drainage channels to dissipate storm flow energy (velocities) prior to entering the EDB.</li> <li>- The IRP Cap was graded so that surface water falling on the IRP Cap, to the extent practicable, drains to the EDB.</li> <li>- The overall design limits peak flows from the EDB outfall structure to less than the discharge flows for the pre-development conditions for SCS Type II 2-, 10-, 25-, and 100-year, 24-hour storm events as given in Reference 28.</li> <li>- A hydrological computer model was utilized to model outflow from the recontoured site and peak flows were compared to pre-development flows given in Reference 28.</li> <li>- Following IRP Cap completion, the model will be calibrated to ensure accuracy and verify that pre-development conditions have been met.</li> <li>- The EDB was designed for longevity and minimal maintenance. The EDB consists of a principal spillway and an emergency spillway with outfall to the east main drainage channel (EMDC).</li> <li>- Compacted earth fill material was utilized for EDB construction and included placement of riprap, Gabion baskets, and AB mats.</li> <li>- The principal spillway structure consists of a multi-stage circular steel drop inlet and pipe conduit and includes an outlet structure (H-flume) to measure stormwater flows from the EDB. Riprap is utilized as an energy dissipator below the outlet structure.</li> <li>- The EDB was designed to contain the 100-year, 24-hour storm event. The emergency spillway is designed for operation during storms greater than the 100-year, 24-hour storm event.</li> <li>- Re-contoured the EDB principal spillway area to the EMDC at approximately 1000 feet MSL to the ledge rock utilizing the natural rock.</li> </ul>

**Table 2-1**  
**Status of SOW Remedial Action Objectives**  
**(4 of 4)**

Number	SOW Remedial Action Objective	Implemented Measure
8 (cont'd.)	Control the Site drainage and minimize the potential for erosion to protect against natural degradation.	<ul style="list-style-type: none"> <li>- Determined that upon completion of the EDB and IRP Cap construction the discharge flows into the EMDC would be reduced such that a headcut structure was not required for additional protection against potential erosion. Placement of a headcut structure along the EMDC would increase the potential of erosion behind the headcut structure.</li> <li>- The last 200-feet of the EMDC, prior to entering No-Name Creek, was redirected by excavating a straighter channel and placing riprap along the 200-foot section for stabilization.</li> </ul>
9	Implement institutional controls to permanently prevent unrestricted use of the Site.	<ul style="list-style-type: none"> <li>- Installation of permanent site survey control monuments along the southwest and northwest corners of MFDS.</li> <li>- Installation of the perimeter fence which allows access from the MFDS access roadway and the permanent fence enclosing the IRP Cap and the entire Restricted Area. <ul style="list-style-type: none"> <li>- The permanent chain link fence is grounded and contains access gates and with locking mechanisms.</li> </ul> </li> <li>- Posting of "Restricted Area Signs".</li> <li>- The Commonwealth acquired buffer zone property (~450 acres) and recorded deed restrictions required pursuant to the Consent Decree.</li> </ul>
10	Implement a site performance and environmental monitoring program.	<ul style="list-style-type: none"> <li>- The Commonwealth is performing environmental monitoring and maintenance during IRP RA pursuant to the IRP Monitoring and Maintenance Plan (January 20, 1998).</li> </ul>

### **3.0 Scope of Work**

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The Maxey Flats IRP RA construction work is ongoing and completion is expected in winter of 2002. The EPA shall issue the IRP RA Certification of Completion following verification of LR/D phase and RW phase construction activities. The Commonwealth of Kentucky is performing general operations and maintenance and will continue to perform operations and maintenance in perpetuity. The Commonwealth of Kentucky will be responsible for completion of the Balance of Remedial Phase comprised of the Interim Maintenance Period (IMP), Final Closure Period, and the Institutional Control Period.

#### **3.1 Environmental Data Collection**

Data collection has been performed during the LR/D and RW phases by the Commonwealth of Kentucky. The Commonwealth of Kentucky collects environmental data pursuant to the IRP Monitoring and Maintenance Plan and submits semi-annual and annual reports to EPA in accordance with the SOW.

Appendix A includes summary of 2001 data during IRP RA activities at points specified in the IMP Performance Standards Verification Plan (PSVP). In summary, the analytical sample results for those points established for monitoring compliance during the IMP PSVP demonstrate that there is no unacceptable risk to human health or the environment based on conditions during IRP RA construction (see Figures A-1 and A-3 for location of alluvial wells and contaminant monitoring points, respectively). EPA has determined that future ARAR compliance is expected and that continued monitoring of alluvial groundwater will continue. Since the remedial action at the Maxey Flats is comprised of multiple phases, the EPA will not assess achievement of ARARs until placement of the final cap is complete. Because access to use of the alluvium within the buffer zone is controlled by the Commonwealth of Kentucky, the alluvial wells will not be used as a drinking water source and therefore do not represent a potential radiological dose.

#### **3.2 Public Participation**

During the IRP RA at Maxey Flats, three open houses were conducted by the EPA, the Maxey Flats Steering Committee and the Commonwealth of Kentucky for the interested public. The next open house is scheduled near completion of the RW construction in fall of 2002. EPA prepared a fact sheet and press statement in 2001 summarizing remedy status and identifying this five-year review. EPA will prepare a fact sheet within 90 days of this initial statutory five-year review to inform the public that a five-year review was done, the scope of the review, where a copy of the report may be obtained and a



summary of any actions taken.

### **3.3 Assessment of Protectiveness**

The selected remedy at the Maxey Flats is expected to be protective of human health and the environment at the completion of the RA. The following conclusions support this determination:

- There are no current or planned changes in land use. Deed restrictions are in place and the property is under the ownership and direct control of the Commonwealth of Kentucky.
- Environmental monitoring demonstrates no unacceptable exposure potential under current conditions.
- HASP and contingency plans are in place and are being properly implemented to control risks during IRP construction activities.
- IRP maintenance and monitoring performed by the Commonwealth of Kentucky is consistent with their IRP Monitoring and Maintenance Plan.
- There are no issues with the initial remedial phase currently under construction.

### **3.4 Deficiencies**

No deficiencies were noted during this initial statutory five-year review.

### **3.5 Recommendations and Required Actions**

No recommendations or required actions are needed based on this five-year review. IRP RA construction should proceed to completion followed by implementation of IMP requirements.

### **3.6 Protectiveness Statements**

The selected remedy at the Maxey Flats is expected to be protective of human health and the environment at the conclusion of the RA, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The EPA Five-Year Review Signature Cover is provided at the beginning of this document.

### **3.7 Next Review Schedule**

Due to the fact that contaminants remain buried above levels that allow for unrestricted use, this site requires that ongoing five-year reviews be conducted in perpetuity. The next five-year review is required by June 2007

## **4.0 References**

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Review references include without limitation the following:

Consent Decree (Civil Action Number 95-58) and the SOW

Health and Safety Plan, Revision 2; June 9, 2001

IRP Monitoring and Maintenance Plan, Commonwealth of Kentucky; January 1998

IRP Remedial Action Work Plan for LR/D; December 5, 1997

IRP Remedial Action Work Plan for RW Construction; February 4, 2000

Maxey Flats Commonwealth of Kentucky Monthly Project Status Reports, Semi-Annual, Annual Reports

Maxey Flats Operating Committee Monthly Project Status Reports; June 1997 to Present

USEPA; OSWER Directives 9355.7-03, Permits and Permit "Equivalency" Processes for CERCLA On-site Response Actions

USEPA; OSWER Directives 9355.7-03B-P, Comprehensive Five-Year Review Guidance, Supersedes OSWER Directives 9355.7-02, -02A, and -03B

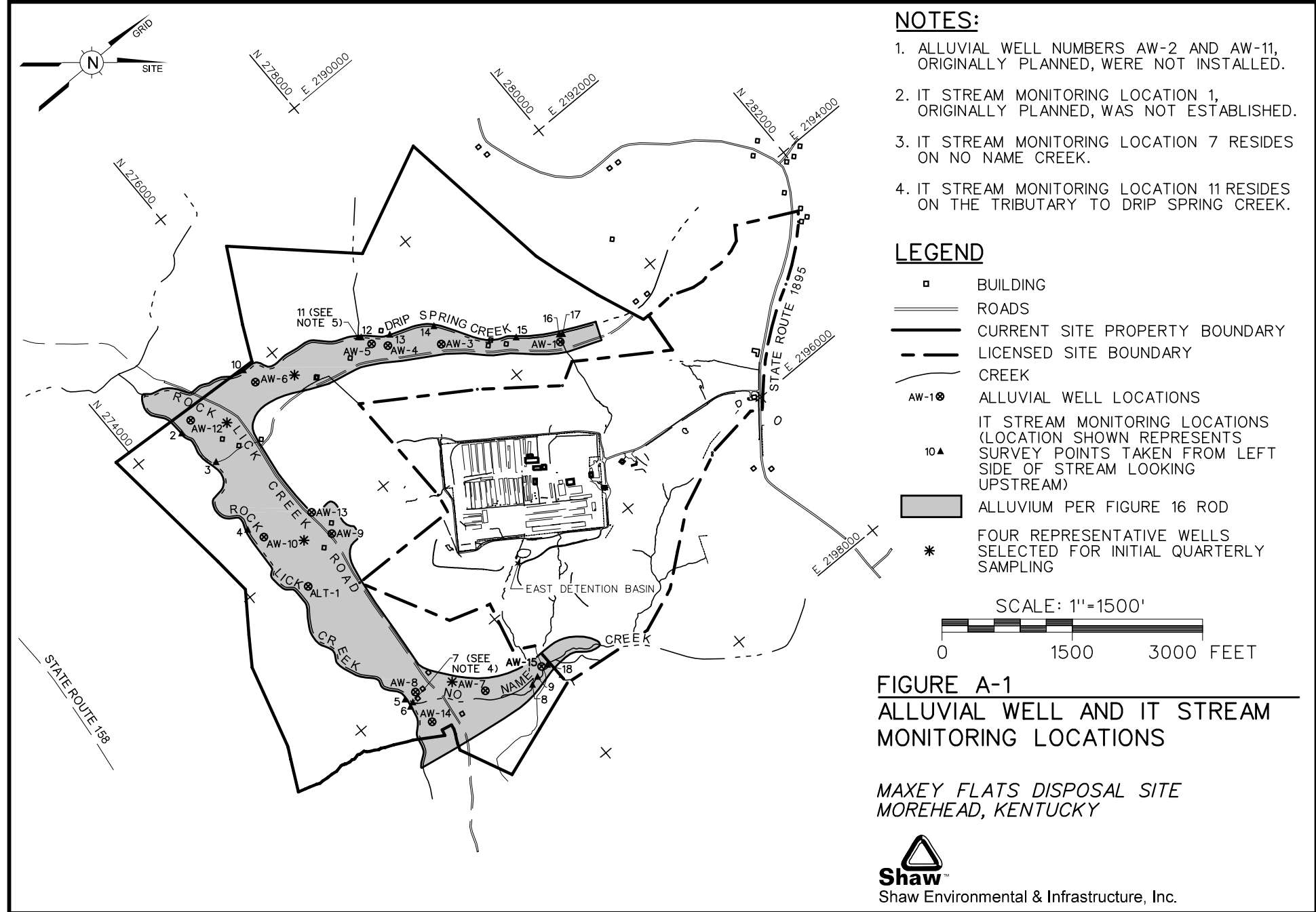
USEPA; Record of Decision, Remedial Alternative Selection for Maxey Flats

## **Appendix A**

### **2001 Data Summary**

## **A-1 – Alluvial Well Monitoring Locations**

STARTING DATE: 03/04/02	DATE LAST REV.: 30MAY02	DRAFT. CHCK. BY: A. BILLMAN	INITIATOR: A. BILLMAN	DWG. NO.: epa-5yr-001.dgn
DRAWN BY: L. STOUT	DRAWN BY: L. STOUT	ENGR. CHCK. BY: A. BILLMAN	PROJ. MGR.: M. CAPPS	PROJ. NO.: 263347



## **A-2 – Alluvial Well Sample Data**

**Summary of Water Elevations  
Alluvial Wells  
Maxey Flats Disposal Site  
Fleming County, KY**

Well ID	TOC Elev. (ft, msl)	Ground Elev. (ft, msl)	Depth to Water (ft btoc)							Water Elevations (ft msl)							Total Depth (ft btoc)
			Oct-01	Nov-01	Dec-01	Jan-02	Feb-02	Apr-02	May-02	Oct-01	Nov-01	Dec-01	Jan-02	Feb-02	Apr-02	May-02	
AW-1	<b>764.78</b>	762.26	10.00	12.30	10.62	9.67	8.80	7.25	6.25	754.78	752.48	754.16	755.11	755.98	757.53	758.53	26.44
AW-3	<b>731.42</b>	729.00	13.23	12.70	8.80	9.42	9.75	7.40	6.25	718.19	718.72	722.62	722.00	721.67	724.02	725.17	20.95
AW-4	<b>712.64</b>	709.79	11.75	8.84	7.30	7.58	8.60	6.60	5.44	700.89	703.80	705.34	705.06	704.04	706.04	707.20	15.91
AW-5	<b>705.63</b>	703.14	5.70	5.95	3.95	5.25	5.27	4.13	3.30	699.93	699.68	701.68	700.38	700.36	701.50	702.33	12.91
AW-6	<b>682.70</b>	680.28	7.93	6.69	4.75	5.75	5.96	5.50	4.65	674.77	676.01	677.95	676.95	676.74	677.20	678.05	18.90
AW-7	<b>718.01</b>	715.61	7.90	7.61	6.72	7.06	7.12	6.20	5.02	710.11	710.40	711.29	710.95	710.89	711.81	712.99	19.94
AW-8	<b>701.30</b>	698.56	7.45	7.43	5.05	6.50	6.74	5.90	5.11	693.85	693.87	696.25	694.80	694.56	695.40	696.19	20.00
AW-9	<b>720.45</b>	718.17	10.85	9.00	8.40	6.17	6.26	3.95	4.88	709.60	711.45	712.05	714.28	714.19	716.50	715.57	16.38
AW-10	<b>679.09</b>	676.49	6.83	6.83	5.30	5.50	5.90	4.35	3.10	672.26	672.26	673.79	673.59	673.19	674.74	675.99	18.42
AW-12	<b>668.51</b>	665.66	9.58	9.28	7.15	7.79	7.80	6.90	5.75	658.93	659.23	661.36	660.72	660.71	661.61	662.76	17.90
AW-13	<b>730.73</b>	728.27	12.67	6.27	2.90	3.75	3.96	0.75	1.37	718.06	724.46	727.83	726.98	726.77	729.98	729.36	21.63
AW-14	<b>706.07</b>	703.25	5.96	5.37	4.59	4.67	4.90	4.40	4.13	700.11	700.70	701.48	701.40	701.17	701.67	701.94	19.95
AW-15	<b>735.50</b>	733.15	9.02	9.06	6.72	6.42	6.55	5.15	4.34	726.48	726.44	728.78	729.08	728.95	730.35	731.16	22.05
ALT-1	<b>686.57</b>	684.27	9.45	9.59	7.05	8.42	8.70	7.18	5.41	677.12	676.98	679.52	678.15	677.87	679.39	681.16	19.95

## **A-3 – Contaminant Monitoring Locations**



26 JUN 2002

c:\cadd\design\epa-5yr-002.dgn

11:24:44

lstout

STARTING DATE: 06/03/02

DATE LAST REV.:

DRAFT. CHCK. BY: A. BILLMAN

INITIATOR: A. BILLMAN

DWG..N@pa-5yr-002.dgn

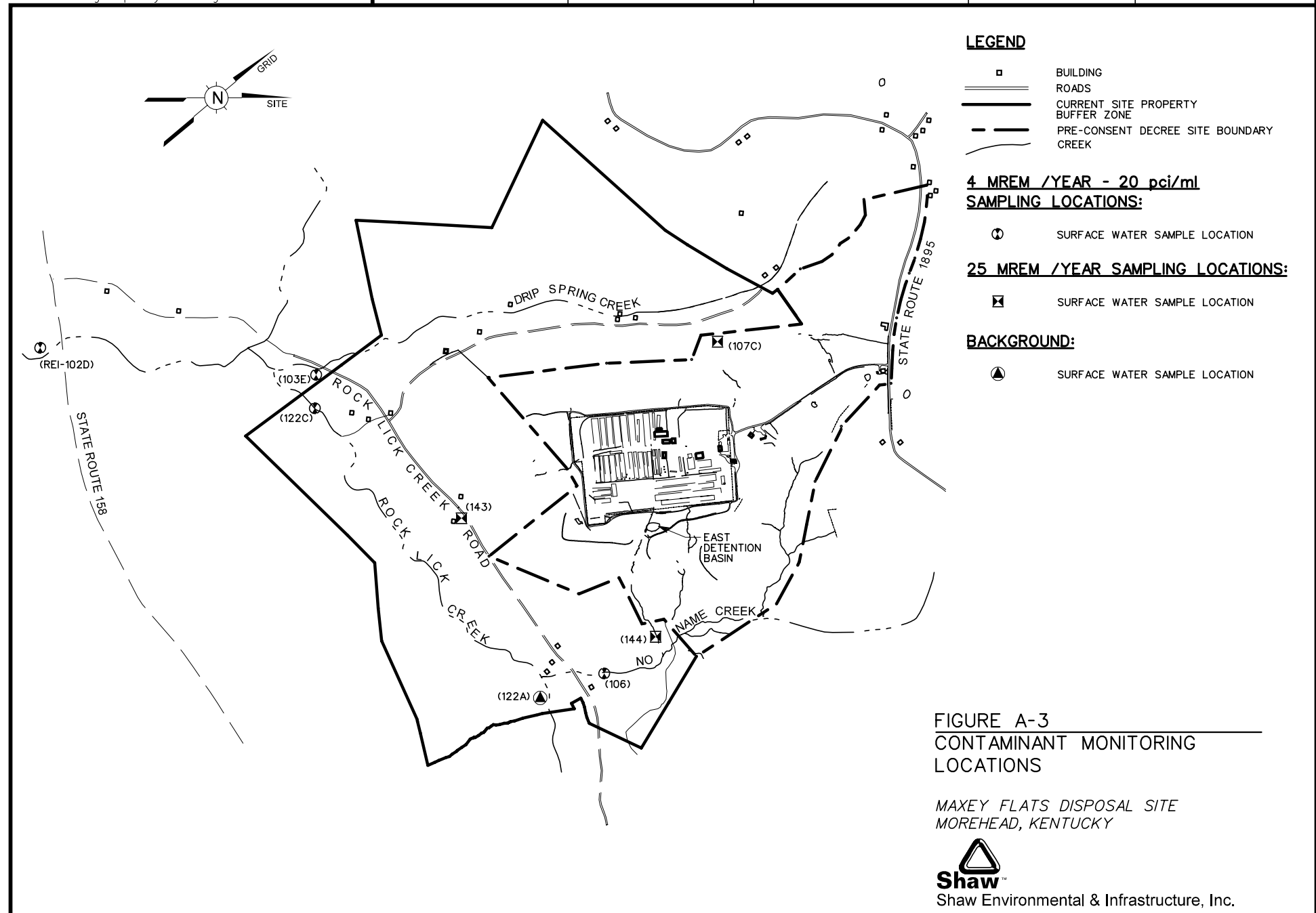
DRAWN BY: L. STOUT

DRAWN BY:

ENGR. CHCK. BY: A. BILLMAN

PROJ. MGR.: M. CAPPS

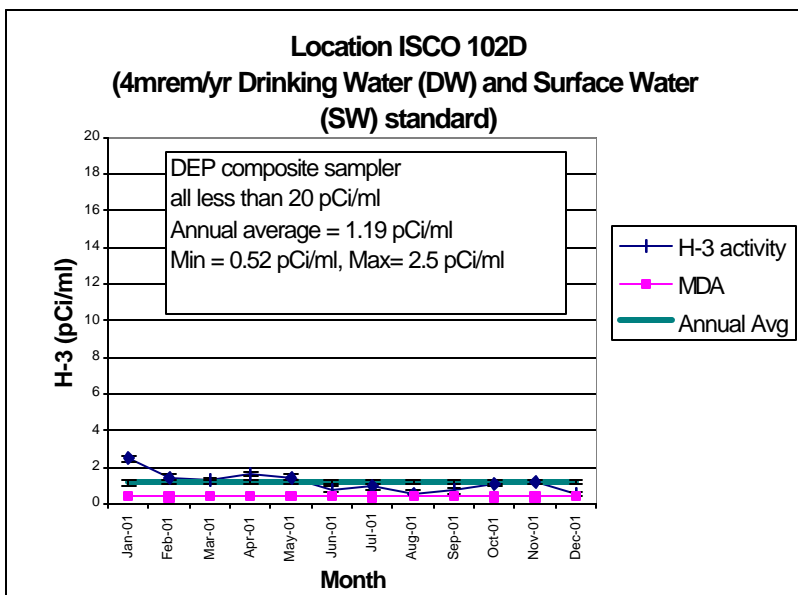
PROJ. NO.: 83374447



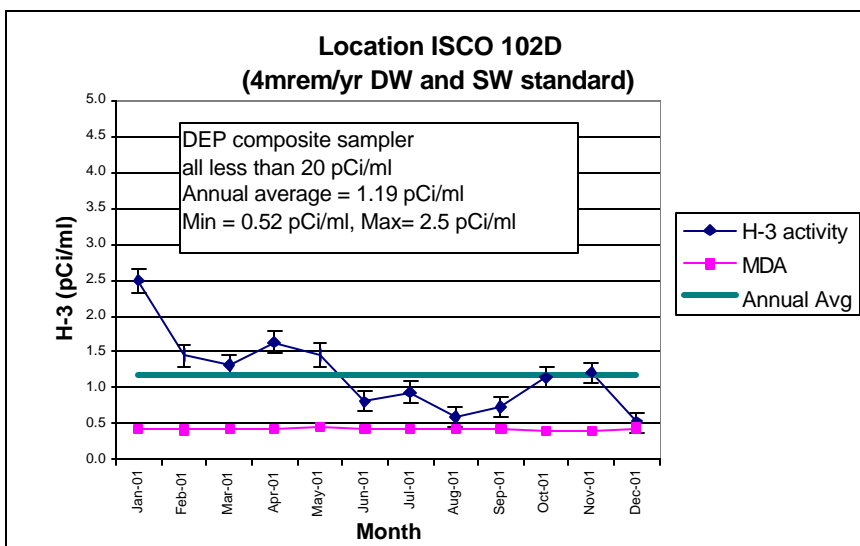
## **A-4 – Stream Sampling Data**

# PSVP Contaminant Specific Monitoring Points: 2001 Data Review of Commonwealth Monitoring

**Figure 1**  
**Drinking Water PSVP Compliance Point 102D**



Note: same figure, different Y-axis

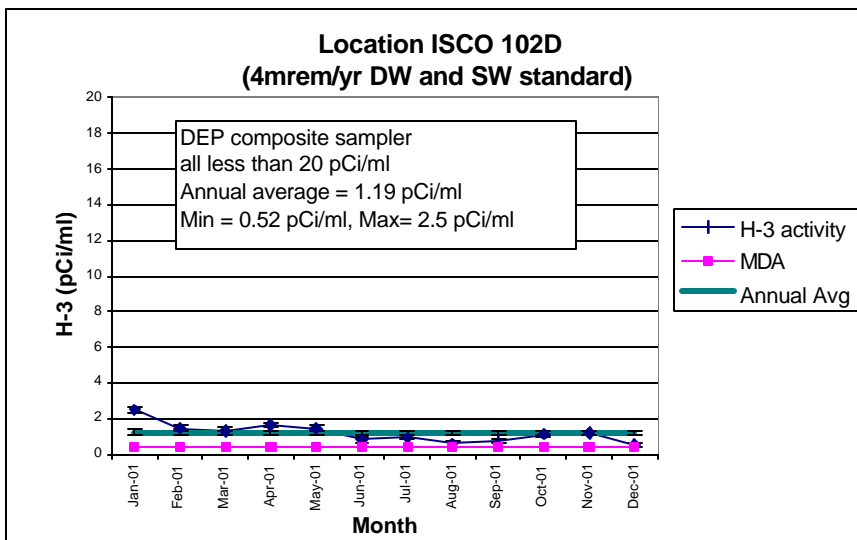


Notes on data analysis:

1. DEP sample from location ISCO 102D composite sampler uses weekly composite samples that are composited into a monthly sample.
2. Annual average was a straight average of the monthly points.

# PSVP Contaminant Specific Monitoring Points: 2001 Data Review of Commonwealth Monitoring

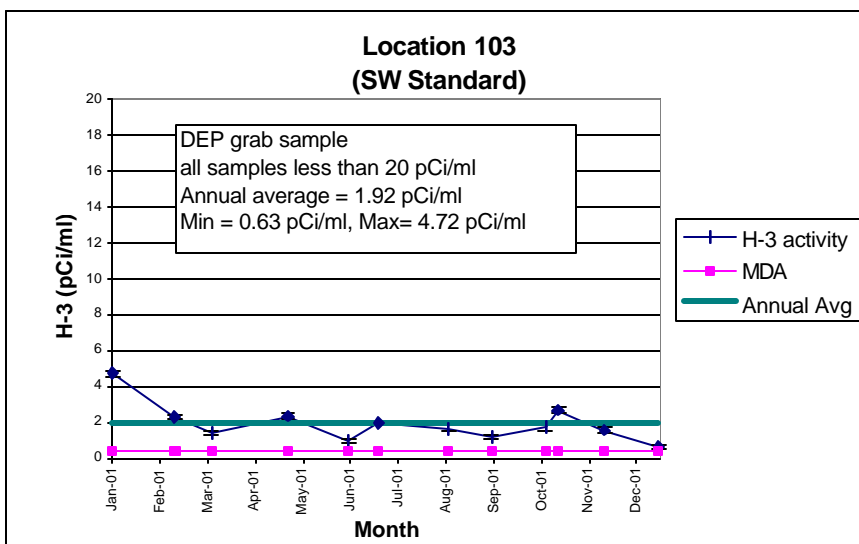
**Figure 2**  
**Perennial Surface Water PSVP Compliance Point 102D**



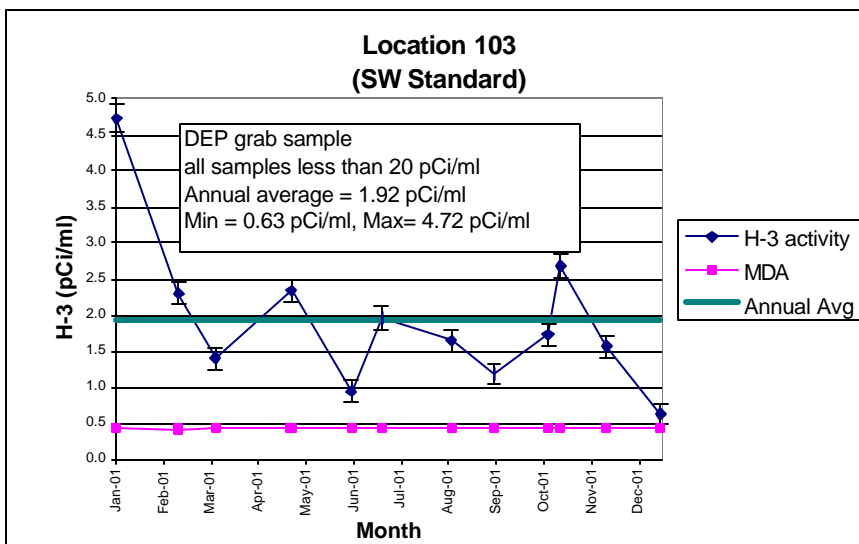
Note: same figure as Figure 1

# PSVP Contaminant Specific Monitoring Points: 2001 Data Review of Commonwealth Monitoring

**Figure 3**  
**Perennial Surface Water PSVP Compliance Point 103**



Note: same figure, different Y-axis

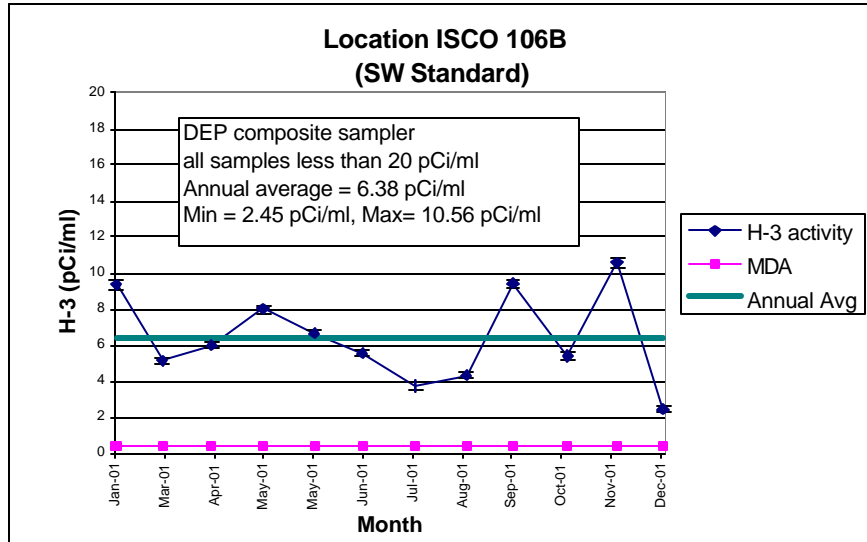


Notes:

1. No data for 103 E, no data for ISCO 103 E, therefore DEP data from 103 used.
2. No data for April, two data points for June, no data for July, two data points for October. Monthly averages were obtained by averaging data for each month. The annual average was obtained by averaging the monthly averages for those months where there was data.
3. Data comparison between DEP and CHS for point 103 showed good agreement for average, minimum, maximum, and standard deviation.

# PSVP Contaminant Specific Monitoring Points: 2001 Data Review of Commonwealth Monitoring

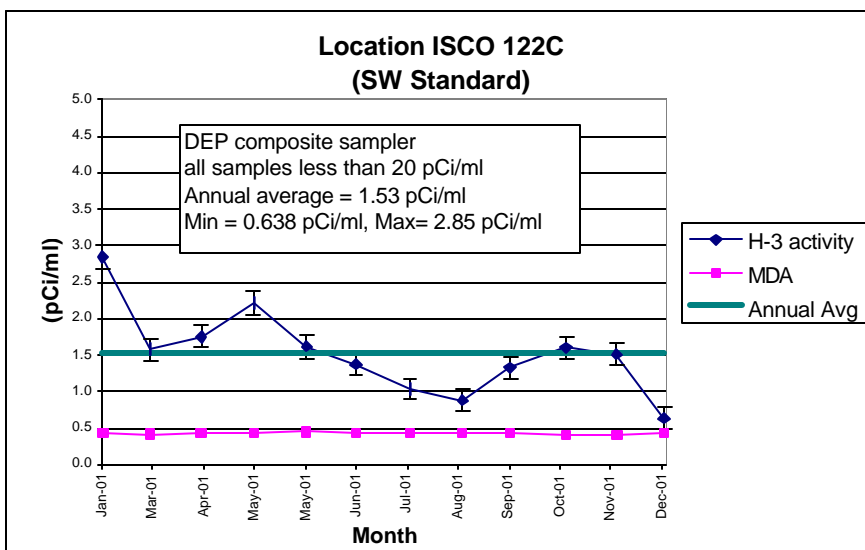
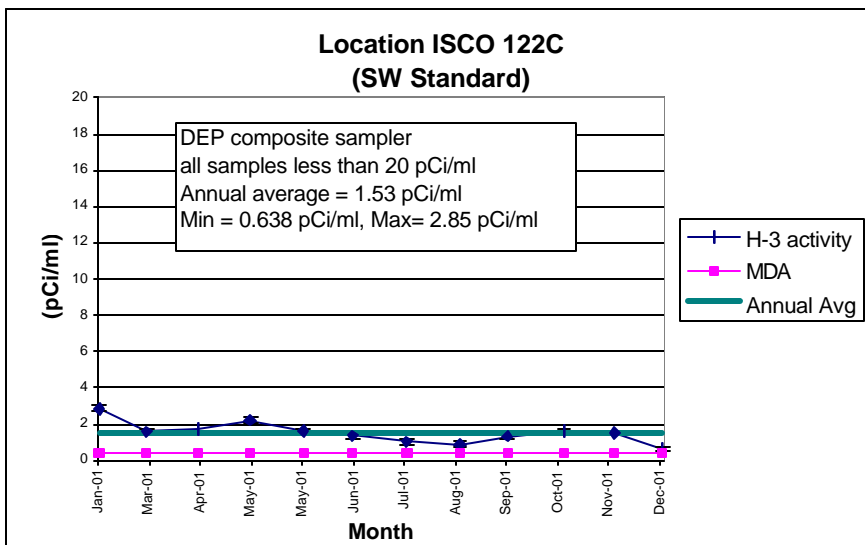
**Figure 4**  
**Perennial Surface Water PSVP Compliance Point 106**



- Notes:
1. DEP ISCO 106B composite sampler chosen ... {although PSVP specifies 106, better data was obtained from composite ISCO 106B sampler}
  2. Comparison between DEP ISCO 106B, DEP 106 grab, and CHS grab samples showed good agreement for average, minimum, maximum, and standard deviation.
  3. Annual average of ISCO 106B was obtained by straight average of 12 monthly composite samples.

# PSVP Contaminant Specific Monitoring Points: 2001 Data Review of Commonwealth Monitoring

**Figure 5**  
**Perennial Surface Water PSVP Compliance Point 122C**



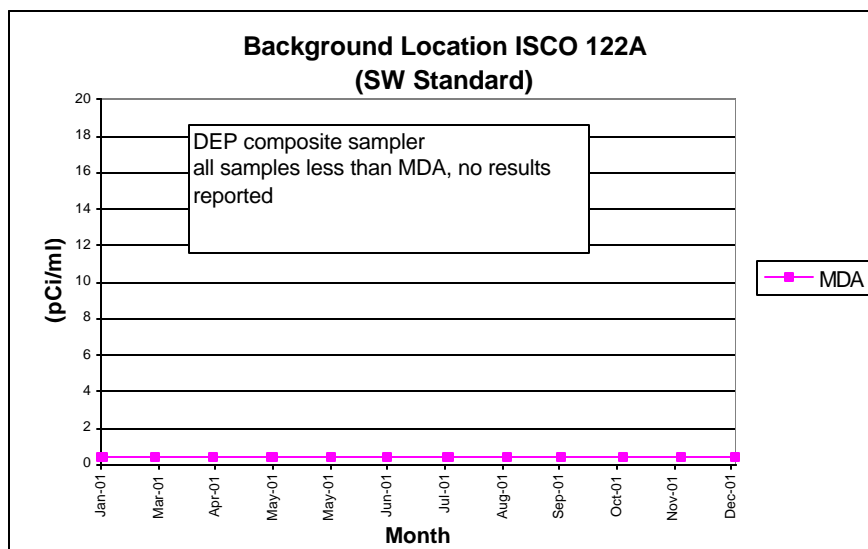
Note: same figure, different Y-axis

Notes:

1. ISCO 122C DEP sample
2. No CHS data for comparison
3. Annual average is a straight average of the 12 monthly composites

# PSVP Contaminant Specific Monitoring Points: 2001 Data Review of Commonwealth Monitoring

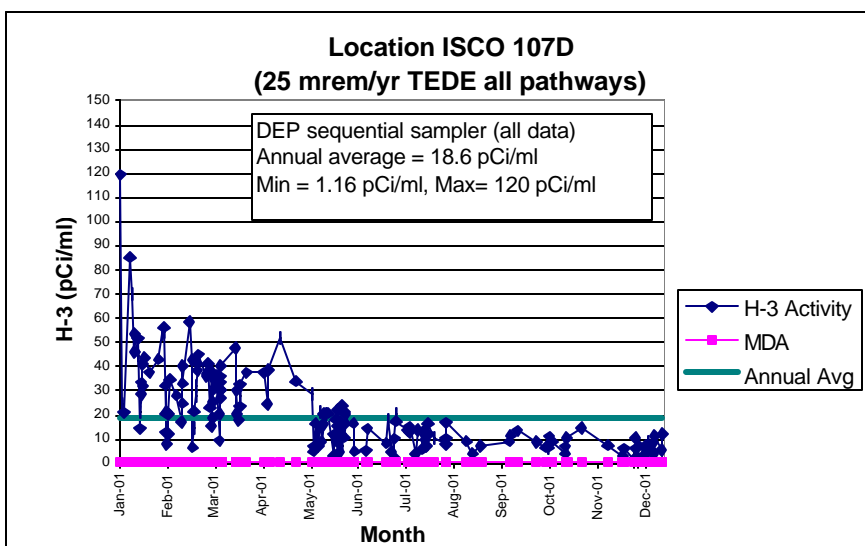
**Figure 6**  
**Perennial Surface Water PSVP Compliance Point 122A**  
**Background Location**



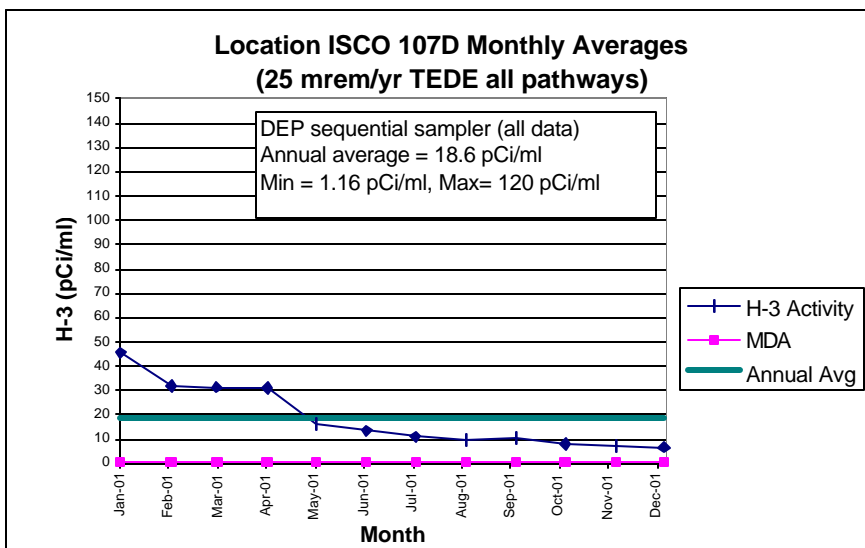


# PSVP Contaminant Specific Monitoring Points: 2001 Data Review of Commonwealth Monitoring

**Figure 7**  
**25 mrem/yr TEDE PSVP Compliance Point ISCO D107**

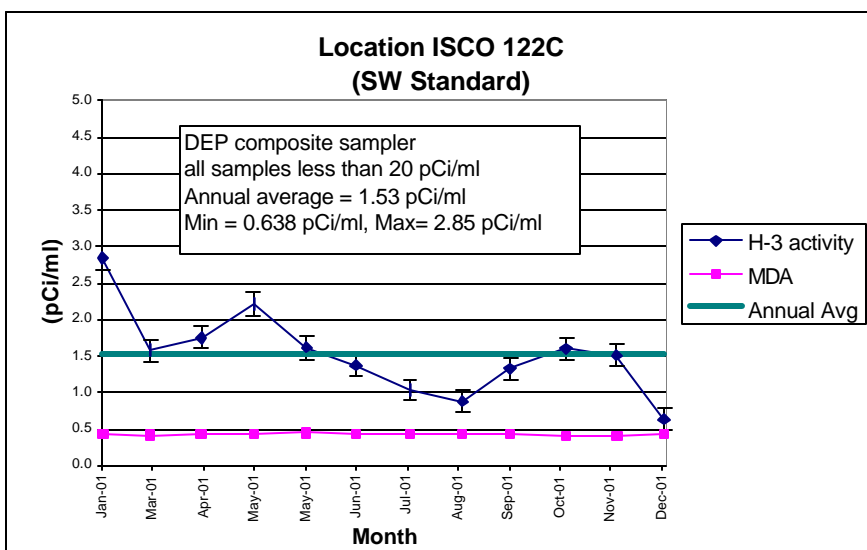
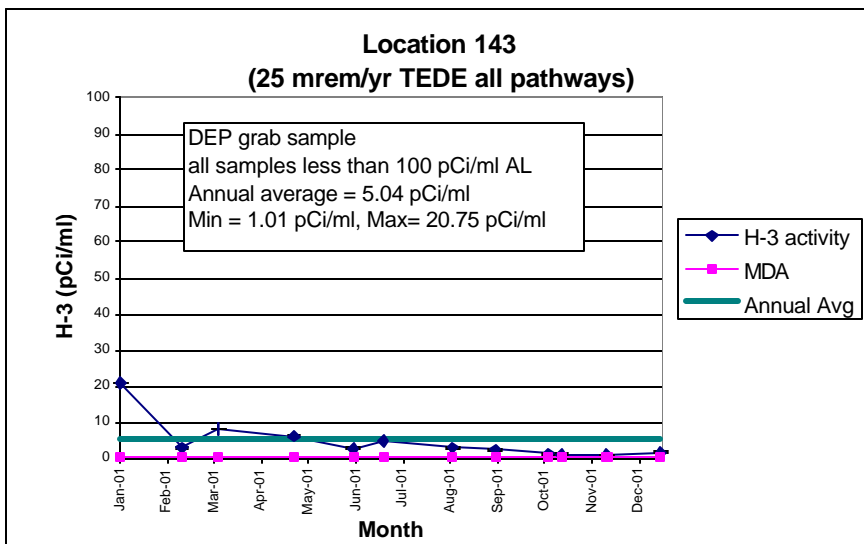


Note: Data presented using monthly averages



# **PSVP Contaminant Specific Monitoring Points: 2001 Data Review of Commonwealth Monitoring**

**Figure 8**  
**25 mrem/yr TEDE PSVP Compliance Point 143**

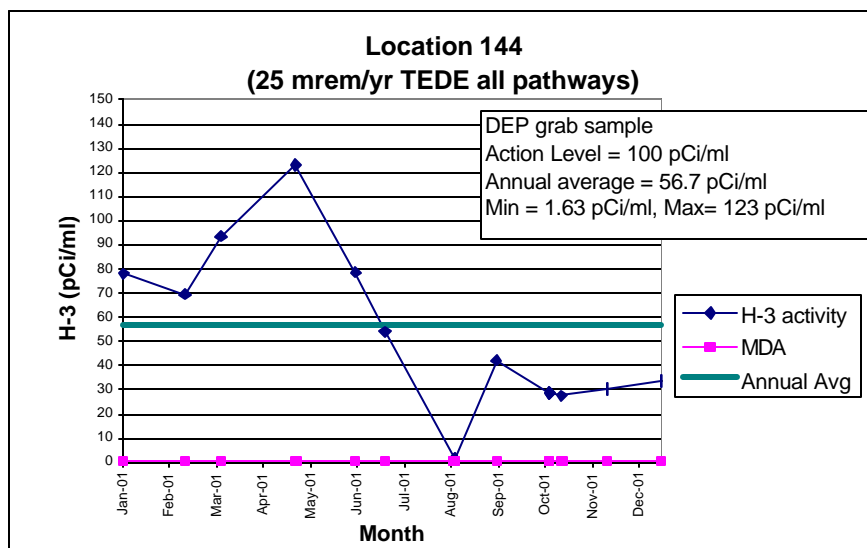


Notes:

1. No data for April, two data points for June, no data for July, two data points for October.

## PSVP Contaminant Specific Monitoring Points: 2001 Data Review of Commonwealth Monitoring

**Figure 9**  
**25 mrem/yr TEDE PSVP Compliance Point 144**



Notes:

1. No data for April, two data points for June, no data for July, three data points for October (two on 10/10 may be a split sample or a duplicate analysis)

## **A-5 – Occupational Exposure Monitoring/ Air Monitoring and Dose Assessment**

## **Maxey Flats Occupational Exposure Monitoring**

The occupational exposure to employees at the Maxey Flats site was determined based on primary dosimeter readings (TLD's), urine bioassay results and supplemented with air sample analysis as necessary.

The Maxey Flats Project complied with the occupational dose limits of the Kentucky Standards for Protection Against Radiation. Additionally, all activities involving radiation and radioactive materials at the Maxey Flats site were conducted in such a manner that the total effective dose equivalent (TEDE) to workers and the general public was maintained ALARA (accounting for the current technology and the economics of radiation exposure reduction in relationship to the benefits of health and safety).

External radiation dose to personnel was measured with TLD's. SRD readings were used to track exposures between quarterly TLD change outs / readings. Only one individual had a recordable dose in 2001; this worker's TEDE for the 2001 was 0.021 rem.

Bioassays were collected from persons issued a TLD. The Maxey Flats bioassay program consisted of gamma spectral and tritium analysis of baseline, annual, termination, and random (generally 1 person each week was randomly selected) urine samples. Additionally, biweekly tritium in urine samples were also collected.

Dose equivalents from the bioassay concentrations were assigned when they exceeded the 10 mrem recording level defined in the HASP. Doses below this level were negligible in comparison to allowable dose limits and were not required to be recorded.

## **Maxey Flats Air Monitoring and Dose Assessment**

The Maxey Flats air monitoring program was designed to demonstrate compliance with the requirements of National Emission Standard for Hazardous Air Pollutants (NESHAP – Clean Air Act) [40 CFR 61, Subparts H and I] in accordance with the ARARs in the ROD. NESHAP requirements specify that the effective dose equivalent to a member of the public from release of airborne radioactive materials must be less than 10 mrem/yr.

Effluent releases were tracked and compared to the limits contained in the Clean Air Act. There were six monitored release points at the MFDS, four on the EMC bunker, one on the vent at the LSF, and one on the vent of the chemistry labhood. The dose

consequences associated with the effluent releases were evaluated using site-specific modeling and the EPA's COMPLY computer code, version 1.5d. The estimated cumulative dose for each year was evaluated for a hypothetical individual living at the MFDS boundary. The resulting dose was compared to the 10 mrem per year air emissions standard.

Data from the measured concentrations at the point of emission were tabulated, the curies released for each period calculated, and the resulting dose equivalent to a member of the public evaluated. The receptor (member of the public) was assumed to be located in the predominant wind direction (North), a distance of 300 meters from the point of emission. The dose equivalent was evaluated for each year, summing the dose contribution from each release point and each nuclide.

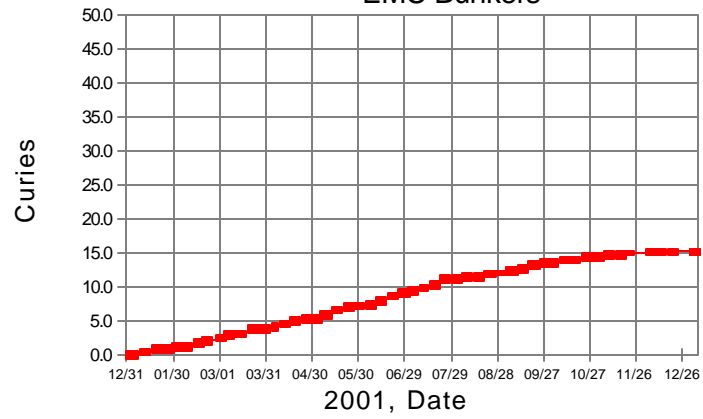
The table below shows the total curies and calculated dose equivalent for 2001. The graphs show the tritium curies from the LSF and the Bunkers and the dose equivalent from the tritium released.

- Tritium accounted for greater than 99 percent of the released activity from each air emissions point.
- Tritium also accounted for greater than 99 percent of the dose equivalent.
- The labhood accounted for less than 1 percent of the released activity and the dose equivalent.
- The total dose equivalent of 0.073 mrem was less than 1 mrem. In accordance with 40 CFR 61.104, MFDS was exempt from the requirement to submit an annual report to the EPA because the results are less than 10 percent of the 10 mrem standard.

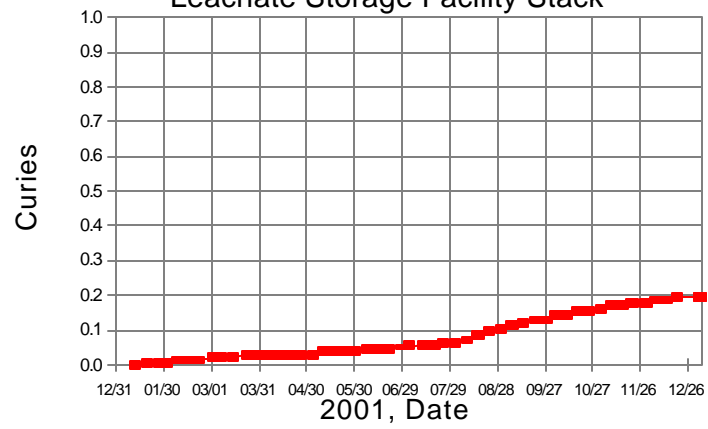
## 2001 Curies and Dose Equivalent from MFDS Air Effluent Release Points

LSF Stack Annual Totals							
	Curies Released			Mrem			
	H-3	Alpha	Beta	H-3	Alpha	Beta	Total Dose
<b>1998</b>	2.94E+00	4.54E-09	1.54E-08	1.56E-02	1.92E-05	6.38E-06	1.56E-02
<b>1999</b>	4.30E+00	2.52E-08	1.01E-07	2.28E-02	1.06E-04	4.16E-05	2.29E-02
<b>2000</b>	2.02E+00	3.81E-08	1.82E-07	1.07E-02	1.61E-04	7.55E-05	1.09E-02
<b>2001</b>	1.96E-01	2.55E-08	1.41E-07	1.04E-03	1.08E-04	5.82E-05	1.21E-03
EMC Bunker Annual Totals							
	Curies			Mrem			
	H-3	Alpha	Beta	H-3	Alpha	Beta	Total Dose
<b>2001</b>	1.52E+01	1.39E-08	3.09E-07	7.16E-02	5.14E-05	1.14E-04	7.17E-02
Labhood Annual Totals							
	Curies			Mrem			
	H-3	Alpha	Beta	H-3	Alpha	Beta	Total Dose
<b>2001</b>	1.46E-02	2.08E-10	2.35E-09	7.88E-05	8.94E-07	9.90E-07	8.07E-05
Annual Totals for All Air Emissions Points							
	Curies			Mrem			
	H-3	Alpha	Beta	H-3	Alpha	Beta	Total Dose
<b>2001</b>	1.54E+01	3.96E-08	4.52E-07	7.27E-02	1.60E-04	1.73E-04	<b>7.30E-02</b>

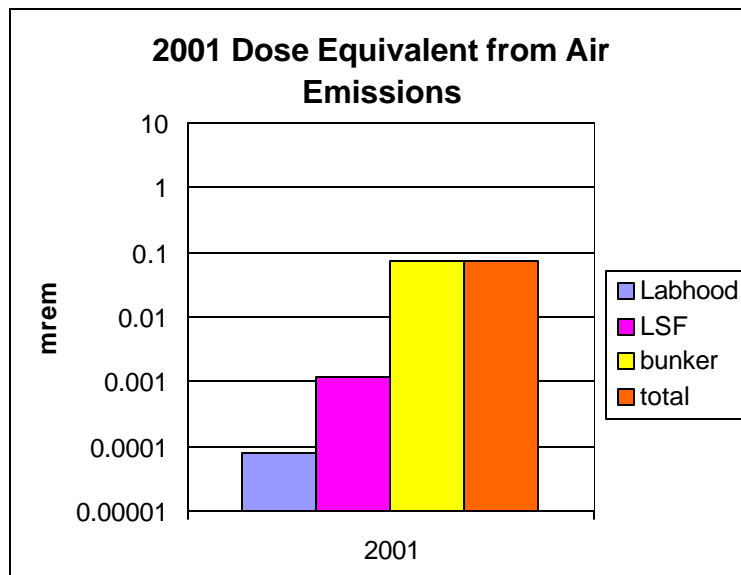
Cumulative H-3 Curies Released  
EMC Bunkers



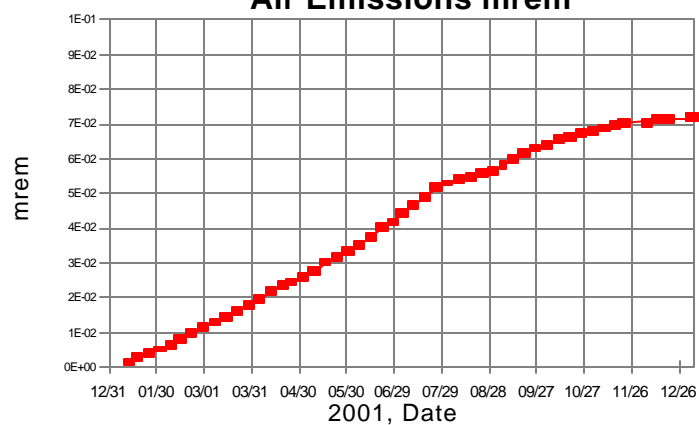
Cumulative H-3 Curies Released  
Leachate Storage Facility Stack







### YTD EMC Bunker Air Emissions mrem



### YTD Leachate Storage Facility Air Emissions mrem

